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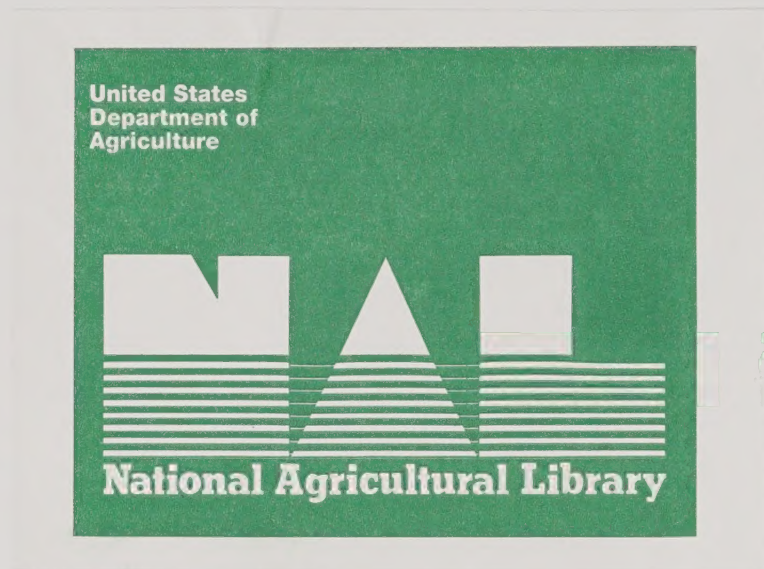
April 2003



Sheep 2001

Part III: Lambing Practices, Spring 2001





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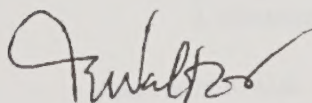
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This report has been prepared from material received and analyzed by the U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS) during a study of animal health and management on sheep operations.

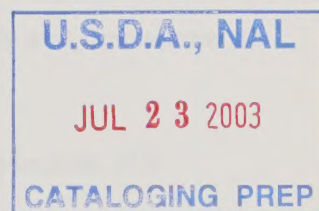
The Sheep 2001 study was a cooperative effort between State and Federal agricultural statisticians, animal health officials, university researchers, extension personnel, and sheep producers. We want to thank the hundreds of industry members who helped determine the direction and objectives of this study by participating in focus groups.

Thanks also to the National Agricultural Statistics Service (NASS) enumerators and State and Federal Veterinary Medical Officers (VMOs) and Animal Health Technicians (AHTs) who visited the operations and collected the data. Their hard work and dedication to the National Animal Health Monitoring System (NAHMS) are invaluable. The roles of the producer, Area Veterinarian in Charge (AVIC), NAHMS Coordinator, VMO, AHT, NASS enumerator, and the lab personnel at the National Veterinary Services Laboratories (NVSL) were critical in providing quality data for Sheep 2001 reports. Thanks also to the personnel at the Centers for Epidemiology and Animal Health (CEAH) for their efforts in generating and distributing timely reports from Sheep 2001 data, and to our reviewers for providing valuable expertise and guidance through their comments.

All participants are to be commended, particularly the producers whose voluntary efforts made the Sheep 2001 study possible.



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Table of Contents

Introduction 1

Terms Used in This Report 3

Section I: Population Estimates 5

A. Inventory and Operation Distribution 5

1. Inventory class distribution 5
2. Primary flock type distribution 7

B. Breeding and Lambing Management 10

1. Lambing completed by July 1, 2001¹ 10
2. Length of lambing season 12
3. Breeding management 14
4. Reproductive outcome 16
5. Fullterm births 17
6. Lambs born alive 19
7. Lambs born per ewe 20
8. Docking 21
9. Grafting and feeding milk replacer 23
10. Lamb deaths 23

Section II: Methodology 26

A. Needs Assessment 26

B. Sampling and Estimation 27

1. State selection 27
2. Operation selection 28
3. Population inferences 29

C. Data Collection 29

D. Data Analysis 29

1. Validation and estimation 29
2. Response rates 30

Appendix I: Sample Profile 33

A. Responding Operations 33

1. Responding Operations by Flock Size 33
2. Responding Operations by Region 33
3. Responding Operations by Primary Flock Type 34

Appendix II: U.S. Sheep and Lamb Inventory and Operations 35

A. Regional Summary 35

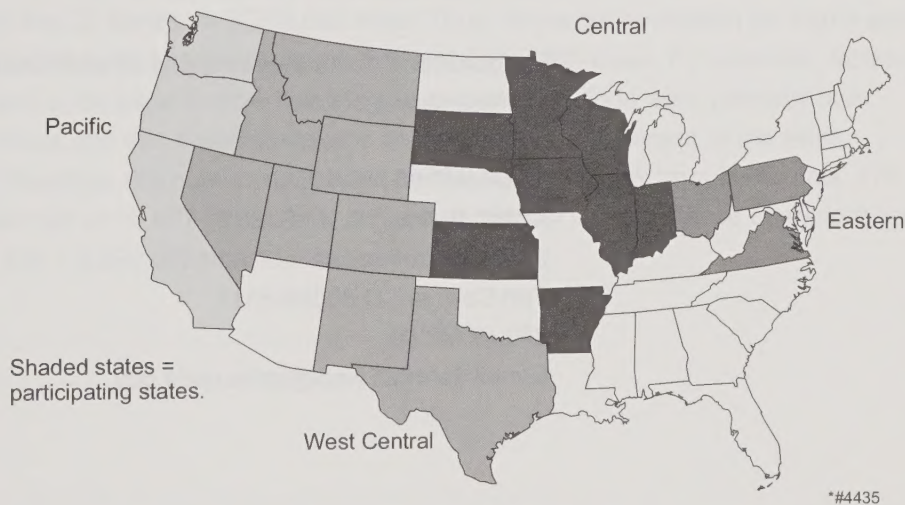
B. Size Group Summary 36

1. Source: United States Census of Agriculture, U.S. Department of Commerce, 1997 36
2. Source: United States Department of Agriculture, NASS 36

Introduction

As part of the National Animal Health Monitoring System (NAHMS), the USDA:APHIS:Veterinary Services (VS) conducted the first national study of the sheep industry with the 1996 NAHMS National Sheep Survey. This was a voluntary mail-in survey, developed through collaboration with the Research and Education Division of the American Sheep Industry Association (ASI), and focused on identifying health and productivity issues affecting America's sheep industry. The 1996 NAHMS study results provided an overview of sheep health, productivity, and management on 5,174 U.S. operations. NAHMS' second national sheep study, NAHMS Sheep 2001, was designed to provide both participants and the industry with information about the U.S. sheep flock on operations with one or more sheep. Specific objectives of this study are described in Section II: Methodology. The USDA's National Agricultural Statistics Service (NASS) collaborated with VS to select a producer sample statistically designed to provide inferences to the nation's sheep population in 22 participating States (see map). These 22 States include the major sheep producing States, accounting for 87.4 percent of the U.S. sheep inventory on January 1, 2001, and 72.3 percent of U.S. sheep producers in 2000. Data for Part I were collected from 3,210 operations in the 22 participating States. NASS interviewers contacted producers and collected data for these reports via a questionnaire administered on-site from December 29, 2000, to January 26, 2001.

States Participating in the Sheep 2001 Study



*Identification numbers area assigned to each graph in this report, for public reference.

Part II: Reference of Sheep Health in the U.S., 2001 is the second of a series of reports containing national information resulting from NAHMS Sheep 2001. Data for this report were collected from 1,101 participating operations that had 20 or more ewes. State and Federal veterinary medical officers (VMOs) and animal health technicians (AHTs) collected the data on operations in the 22 participating States between February 5, 2001, and April 27, 2001. The 22-State target population of operations with 20 or more ewes was estimated to represent 42.1 percent of all sheep operations and 92.6 percent of ewes in the 22 States on January 1, 2001.

Part III: Lambing Practices, Spring 2001 is the third of a series of reports from NAHMS Sheep 2001. Data for this report were collected by State and Federal VMOs and AHTs from 870 participating operations via a telephone survey administered from June 4 to June 29, 2001. To be eligible for the telephone survey, operations had to have 20 or more ewes on-site on January 1, 2001, and must have completed lambing by July 1, 2001.

Comparisons between responses to similar questions in the 1996 and 2001 studies will be made when available and appropriate. However, these comparisons are made with caution, as the study populations and survey designs are different. NAHMS results within this report are available at: www.aphis.usda.gov/vs/ceah/cahm

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Terms Used in This Report

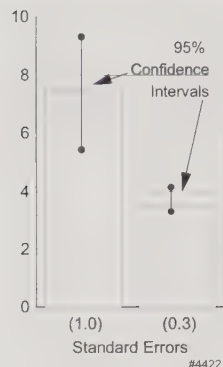
N/A: Not applicable.

Flock size: Data throughout this report are often summarized by three size groupings or categories based on the **number of ewes one year old or older** reported for each operation on January 1, 2001. The three size groupings are: less than 100; 100 to 499; 500 or more.

Operation average A single value for each operation is summed over all operations reporting divided by the number of operations reporting.

Percentage: Data in tables are reported by percentage of operations or by percentage of lambs or sheep. Data in Appendix II are provided to aid in the interpretations of the estimates in these tables. When using Appendix II keep in mind that the target population is the 22 States for operations with 20 or more ewes. Using the NASS inventory data listed in Appendix II, the majority of tables in this report can be recalculated to determine the number of operations, or sheep and lambs, that are represented by the category in the table. The NASS inventory data in Appendix II indicate that there are 47,800 operations in the 22 participating States and that 42.1 percent had 20 or more ewes (20,124 operations). The ewe inventory for the 22 States was 3,563,000 head, and those operations with 20 or more ewes accounted for 92.6 percent of all ewes in the 22 States, or 3,299,000 head. Thus, the target population for Part II and Part III is 20,124 sheep operations and 3,299,000 ewes. For example, tables a. and b. on page 8 show that 77.9 percent of operations were primarily farm flocks and that these operations accounted for 33.8 percent of the ewes. Therefore, the number of operations that were primarily farm flocks was $.779 \times 20,124$ or 15,677 operations, and the number of ewes on these operations was $.338 \times 3,299,000$ or 1,115,062 head.

Examples of a
95% Confidence Interval



Population Estimates: Estimates in this report are provided with an measure of precision called the **standard error**. A 95 percent confidence interval can be created with upper and lower bounds equal to the estimate plus or minus two standard errors, respectively. If the only error is sampling error, then confidence intervals created in this manner will contain the true population mean approximately 95 out of 100 times. In the example to the left, an estimate of 7.5 with a standard error of 1.0 results in limits of 5.5 to 9.5 (two times the standard error above and below the estimate). The second estimate of 3.4 shows a standard error of 0.3 and results in limits of 2.8 and 4.0. Alternatively, the 90 percent confidence interval would be created by multiplying the standard error by 1.65 instead of 2. Most estimates in this report are rounded to the nearest tenth. If rounded to 0, the standard error was reported. If there were no reports of the event, no standard error was reported.

Primary Flock Type: Because some producers manage more than one type of flock, they were asked to identify their **primary** flock type (e.g., open, fenced range, etc.). Therefore, data throughout this report are often summarized by three flock types (self-classified by the producers): herded/open range; fenced range; and farm flock. The category “all operations” includes feedlots. However, only 0.7 percent of operations with 20 or more ewes on January 1, 2001, were primarily feedlots. These operations, while not representative of feedlots in general, did represent the few feedlot operations that also raised ewes.

Regions:**Pacific:** California, Oregon, and Washington

West Central: Colorado, Idaho, Montana, New Mexico, Nevada, Utah, Texas, and Wyoming

Central: Arkansas, Illinois, Indiana, Iowa, Kansas, Minnesota, South Dakota, and Wisconsin

Eastern: Ohio, Pennsylvania, and Virginia

Sample Profile: Information that describes characteristics of the sites where Sheep 2001 data were collected, such as operations responding by flock sizes. (See Appendix I).

Total Inventory: All sheep and lambs present on the operation January 1, 2001.

Section I: Population Estimates

A. Inventory and Operation Distribution

1. Inventory class distribution

a. Percentage of sheep and lamb inventory on June 1, 2001, by class:

b. Percentage of ewes on June 1, 2001, by age and by region:

Class	Percent Sheep and Lambs	Standard Error
Unweaned lambs	34.1	(0.9)
Weaned lambs less than 1 year old	14.7	(0.9)
Castrated males 1 year or older	0.5	(0.1)
Rams 1 year or older	1.9	(0.1)
Ewes 1 to 2 years old	13.3	(0.4)
Ewes 3 to 4 years old	21.4	(0.6)
Ewes 5 years or older	14.1	(0.5)
Total	100.0	

c. Percentage of ewes on June 1, 2001, by age and by flock size:

Percent Ewes										
Region										
Age (in Years)	Pacific		West Central		Central		Eastern		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
1 to 2	28.9	(2.9)	26.4	(1.2)	28.0	(1.3)	25.8	(1.9)	27.1	(0.9)
3 to 4	41.4	(2.7)	46.6	(1.6)	39.6	(1.3)	38.7	(2.5)	43.9	(1.0)
5 or more	29.7	(2.7)	27.0	(1.4)	32.4	(1.6)	35.5	(2.8)	29.0	(1.0)
Total	100.0		100.0		100.0		100.0		100.0	

d. Percentage of ewes on June 1, 2001, by age and by primary flock type:

Percent Ewes						
Flock Size (Number of Ewes 1 Year or Older)						
Age (in Years)	Small (Less than 100)		Medium (100-499)		Large (500 or More)	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
1 to 2	29.6	(1.1)	24.9	(1.3)	27.0	(1.4)
3 to 4	38.8	(1.2)	41.1	(1.3)	47.4	(1.8)
5 or more	31.6	(1.4)	34.0	(1.6)	25.6	(1.6)
Total	100.0		100.0		100.0	

Percent Ewes						
Primary Flock Type						
Herded/Open Range			Fenced Range		Farm Flock	
Age (in Years)	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
1 to 2	29.3	(1.9)	24.3	(1.6)	28.7	(0.9)
3 to 4	46.7	(1.9)	46.4	(1.9)	38.7	(1.0)
5 or more	24.0	(2.2)	29.3	(1.8)	32.6	(1.1)
Total	100.0		100.0		100.0	

2. Primary flock type distribution

The majority (77.9 percent) of operations were farm flocks, which accounted for 33.8 percent of ewes. Only 0.7 percent of operations with 20 or more ewes on January 1, 2001, were primarily feedlots. These operations, while not representative of feedlots in general, did represent the few feedlot operations that also raised ewes. Farm flocks in the Central and Eastern regions represented 90.7 percent and 99.2 percent, respectively, of all operations with 20 or more ewes in those regions. There were more fenced range (49.3 percent) and herded/open range (5.6 percent) operations in the West Central region than in any of the other regions.

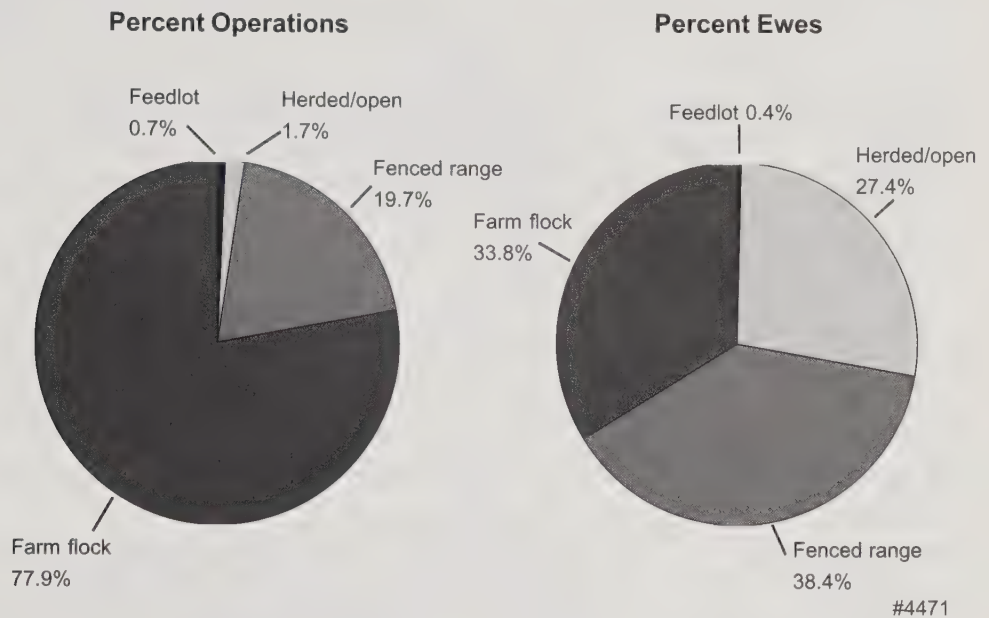
a. Percentage of operations by primary flock type and by region:

Primary Flock Type	Percent Operations				
	Region				All
	Pacific	West Central	Central	Eastern	Operations
	Std. Pct. Error	Std. Pct. Error	Std. Pct. Error	Std. Pct. Error	Std. Pct. Error
Herded/ Open range	2.0 (0.9)	5.6 (0.8)	0.0 (—)	0.0 (—)	1.7 (0.2)
Fenced range	17.8 (4.7)	49.3 (4.5)	9.1 (2.9)	0.6 (0.3)	19.7 (2.1)
Farm flock	76.4 (5.5)	45.0 (4.5)	90.7 (2.9)	99.2 (0.4)	77.9 (2.1)
Feedlot	3.8 (3.6)	0.1 (0.1)	0.2 (0.1)	0.2 (0.2)	0.7 (0.5)
Total	100.0	100.0	100.0	100.0	100.0

b. Percentage of ewes by primary flock type and by region:

Primary Flock Type	Percent Ewes				
	Region				All
	Pacific	West Central	Central	Eastern	Operations
	Std. Pct. Error	Std. Pct. Error	Std. Pct. Error	Std. Pct. Error	Std. Pct. Error
Herded/ Open range	16.9 (6.4)	42.1 (3.0)	0.0 (—)	0.0 (—)	27.4 (2.2)
Fenced range	46.1 (6.5)	47.6 (2.9)	14.3 (3.5)	4.4 (1.9)	38.4 (2.1)
Farm flock	36.0 (4.5)	10.0 (0.9)	85.3 (3.5)	95.4 (1.9)	33.8 (1.5)
Feedlot	1.0 (1.0)	0.3 (0.2)	0.4 (0.2)	0.2 (0.2)	0.4 (0.2)
Total	100.0	100.0	100.0	100.0	100.0

Percent of Operations and Percent of Ewes on These Operations, by Primary Flock Type



While farm flocks accounted for 85.8 percent of all small flocks, they represented only 9.8 percent of all large flocks. Similarly, herded/open range flocks accounted for only 0.2 percent of all small operations but represented 30.0 percent of all large operations.

c. Percentage of operations by primary flock type and by flock size:

Percent Operations						
Primary Flock Type	Flock Size (Number of Ewes 1 Year or Older)					
	Small (Less than 100)		Medium (100-499)		Large (500 or More)	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Herded/Open range	0.2	(0.1)	1.2	(0.6)	30.0	(2.8)
Fenced range	13.2	(2.6)	40.3	(3.0)	59.7	(3.1)
Farm	85.8	(2.6)	58.4	(3.0)	9.8	(1.7)
Feedlot	0.8	(0.6)	0.1	(0.1)	0.5	(0.4)
Total	100.0		100.0		100.0	

d. Percentage of ewes by primary flock type and by flock size:

Percent Ewes						
Flock Size (Number of Ewes 1 Year or Older)						
Primary Flock Type	Small (Less than 100)		Medium (100-499)		Large (500 or More)	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Herded/Open range	0.2	(0.2)	1.8	(0.9)	50.4	(3.6)
Fenced range	14.6	(2.6)	46.5	(3.2)	45.3	(3.6)
Farm	84.4	(2.6)	51.5	(3.2)	4.0	(1.1)
Feedlot	0.8	(0.6)	0.2	(0.1)	0.3	(0.3)
Total	100.0		100.0		100.0	

B. Breeding and Lambing Management

Note: Only operations that had completed lambing by July 1, 2001, were included in the remainder of this report. However, since most (92.9 percent) operations had completed lambing by then, very few were excluded.

Fewer herded/open range (89.6 percent) and fenced range (83.8 percent) flocks had completed lambing by July 1, 2001, than had farm flocks (95.3 percent).

1. Lambing completed by July 1, 2001¹

a. Percentage of operations that completed lambing by July 1, 2001, by flock size:

Percent Operations					
Flock Size (Number of Ewes 1 Year or Older)					
Small (Less than 100)		Medium (100-499)		Large (500 or more)	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
93.5	(1.8)	91.1	(2.0)	90.0	(2.0)

¹Interviews were conducted from June 4 to June 29, 2001. Any operations that completed the survey should have finished lambing by the time of the interview. Therefore, lambing would have been completed by July 1, 2001.

b. Percentage of operations that completed lambing by July 1, 2001, by region:

Percent Operations									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
98.1	(1.1)	90.4	(3.4)	93.4	(2.3)	91.1	(3.3)	92.9	(1.5)

c. Percentage of operations that completed lambing by July 1, 2001, by primary flock type:

Percent Operations					
Primary Flock Type					
Herded/Open Range		Fenced Range		Farm Flock	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
89.6	(2.9)	83.8	(5.9)	95.3	(1.1)

2. Length of lambing season

The average length of the lambing season for all operations was 79.6 days. The length of the lambing season varied little by flock type. For this report, lambing season is longer than that reported in *Part I: Reference of Sheep Management in the United States, 2001*, where the lambing season was 55.8 days. Part I included operations with 1 to 19 ewes, which frequently have lambing seasons of very short duration. Therefore, the length of lambing season reported below represents flocks with 20 or more ewes.

a. For operations that completed lambing by July 1, 2001, average length (in days) of lambing season, by primary flock type:

Average Number Days							
Primary Flock Type							
Herded/Open Range		Fenced Range		Farm Flock		All Operations	
Days	Std. Error	Days	Std. Error	Days	Std. Error	Days	Std. Error
72.5	(4.8)	81.8	(5.0)	78.3	(3.1)	79.6	(2.7)

Nearly 40.0 percent of operations had a lambing season of 85 days or longer. The length of the lambing season varied little by region

i. For operations that completed lambing by July 1, 2001, percentage of operations by length (in days) of lambing season and by region:

Percent Operations										
Number of Days	Region									
	Pacific		West Central		Central		Eastern		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Less than or equal to 14	4.0	(3.1)	1.2	(0.8)	4.5	(2.5)	1.8	(1.2)	3.3	(1.3)
15 to 42	18.7	(5.9)	21.0	(3.4)	25.1	(4.3)	18.3	(4.9)	22.2	(2.5)
43 to 84	34.6	(6.3)	37.5	(4.5)	34.1	(4.2)	31.3	(5.9)	34.6	(2.6)
85 or more	42.7	(6.4)	40.3	(4.8)	36.3	(4.3)	48.6	(6.7)	39.9	(2.7)
Total	100.0		100.0		100.0		100.0		100.0	

- ii. For operations that completed lambing by July 1, 2001, percentage of operations by length (in days) of lambing season and by primary flock type:

Percent Operations						
Primary Flock Type						
Herded/Open Range			Fenced Range		Farm Flock	
Number of Days	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Less than or equal to 14	0.0	(—)	3.7	(2.6)	3.2	(1.5)
15 to 42	22.2	(4.9)	18.5	(4.4)	23.3	(2.9)
43 to 84	50.9	(6.8)	42.1	(6.0)	32.9	(2.9)
85 or more	26.9	(5.2)	35.7	(5.6)	40.6	(3.1)
Total	100.0		100.0		100.0	

3. Breeding management

- a. For operations that completed lambing by July 1, 2001, percentage of operations (and percentage of ewes), by breeding management (exposed to a ram or artificially inseminated, or obtained already bred):

Breeding Management	Percent Operations	Std. Error	Percent Ewes	Std. Error
Exposed to ram or artificially inseminated	99.7	(0.1)	98.9	(0.3)
Obtained already bred	3.3	(0.7)	1.1	(0.3)
Total			100.0	

Nearly one in five (17.3 percent) bred ewes were in their first pregnancy. This percentage varied little by region or flock type. However, as flock size increased the percentage of bred ewes in their first pregnancy decreased.

b. Percentage of total bred ewes that were in their first pregnancy, by region:

Percent Ewes									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
17.7	(1.4)	16.2	(0.7)	19.0	(0.9)	21.0	(1.6)	17.3	(0.5)

c. Percentage of total bred ewes that were in their first pregnancy, by primary flock type:

Percent Ewes					
Primary Flock Type					
Herded/Open Range		Fenced Range		Farm Flock	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
16.4	(1.2)	15.5	(0.9)	19.9	(0.7)

d. Percentage of total bred ewes that were in their first pregnancy, by flock size:

Percent Ewes					
Flock Size (Number Ewes 1 Year or Older)					
Small (Less than 100)		Medium (100-499)		Large (500 or more)	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
20.3	(0.8)	17.4	(0.9)	15.8	(0.8)

4. Reproductive outcome

For operations that had completed lambing by July 1, 2001, 90.5 percent of bred ewes on these operations had fullterm births. This percentage varied little by flock size. The “open” category in the table below represents producers who did not know whether or not ewes were bred and did not become pregnant, or whether they were bred, became pregnant, but aborted.

a. For operations that completed lambing by July 1, 2001, percentage of bred ewes by reproductive outcome and by flock size:

Reproductive Outcome	Percent Ewes							
	Flock Size (Number of Ewes 1 Year or Older)							
	Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Never became pregnant	5.2	(0.6)	3.7	(0.4)	3.6	(0.5)	4.0	(0.3)
Became pregnant but were removed prior to lambing	0.7	(0.2)	1.6	(0.6)	0.4	(0.1)	0.8	(0.2)
Became pregnant but died prior to or during lambing	2.0	(0.2)	1.9	(0.1)	1.5	(0.1)	1.7	(0.1)
Aborted	1.0	(0.2)	1.0	(0.1)	0.6	(0.1)	0.8	(0.1)
Full-term births (both live and dead)	89.7	(0.7)	89.0	(0.7)	91.6	(0.5)	90.5	(0.4)
Open (unknown if aborted or never pregnant)	1.4	(0.3)	2.8	(0.4)	2.3	(0.3)	2.2	(0.2)
Total	100.0		100.0		100.0		100.0	

While only 17.3 percent of all bred ewes were in their first pregnancy (table 3b), 39.5 percent of ewes that aborted were in their first pregnancy.

b. For ewes that aborted, percentage of ewes that were expecting their first lamb, by flock size:

Percent Ewes							
Flock Size (Number of Ewes 1 Year or Older)							
Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
41.0	(8.0)	43.9	(9.2)	33.2	(3.9)	39.5	(4.4)

Small flocks had a higher percentage (11.8 percent) of ewes that were physically assisted with birth than did medium (6.1 percent of ewes) or large (6.2 percent of ewes) flocks.

c. For ewes that had fullterm births, percentage of ewes that were physically assisted with the birth, by flock size:

Percent Ewes							
Flock Size (Number of Ewes 1 Year or Older)							
Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
11.8	(1.4)	6.1	(0.5)	6.2	(1.4)	7.7	(0.8)

5. Fullterm births

Just over half (51.2 percent) of all ewes had single births. However, this percentage was lower for ewes in the Central and Eastern regions and higher for ewes in the Pacific and West Central regions. Similarly, a higher percentage of ewes had twins and triplets in the Central and Eastern regions than did ewes in the Pacific and West Central regions.

	Percent Ewes									
	Region									
	Pacific		West Central		Central		Eastern		All Operations	
Lambing Outcome	Std. Pct.	Error	Std. Pct.	Error	Std. Pct.	Error	Std. Pct.	Error	Std. Pct.	Error
Single births	53.6	(2.1)	58.0	(1.7)	38.3	(1.6)	36.2	(2.4)	51.2	(1.1)
Twins	42.9	(1.9)	38.0	(1.5)	52.0	(1.3)	51.0	(2.1)	43.1	(0.9)
Triplets	3.3	(0.5)	3.6	(0.4)	8.7	(0.8)	11.7	(1.5)	5.2	(0.3)
More than three	0.2	(0.1)	0.4	(0.1)	1.0	(0.3)	1.1	(0.5)	0.5	(0.1)
Total	100.0		100.0		100.0		100.0		100.0	

Percent

Single births Twins Triplets More than 3

Region	Single births	Twins	Triplets	More than 3
Pacific	53.6	42.9	3.3	0.2
West Central	58.0	38.0	3.6	0.4
Central	38.3	52.0	8.7	1.0
Eastern	36.2	51.0	11.7	1.1
All Operations	51.2	43.1	5.2	0.5

Region

6. Lambs born alive

Farm flocks, flocks in the Central and Eastern regions, and small-sized flocks all had between 94.0 and 95.0 percent of their lambs born alive, while range flocks, flocks in the West Central region, and large-sized flocks all reported more than 97.0 percent of their lambs were born alive. Small operations are able usually to attend more births, and therefore are able to keep more accurate records of the number of lambs born dead or alive than are large operations. Thus, the smaller percentage of lambs born alive on small farm flocks (the predominant flock type in the Central and Eastern regions) may be the result of more complete records, rather than a true difference between flock types, sizes, and regions.

a. Percentage of lambs born alive (number of lambs born alive as a percentage of all lambs born), by flock size:

Percent Lambs							
Flock Size (Number of Ewes 1 Year or Older)							
Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
94.9	(0.3)	96.1	(0.3)	97.2	(0.2)	96.2	(0.2)

b. Percentage of lambs born alive (number of lambs born alive as a percentage of all lambs born), by region:

Percent Lambs							
Region							
Pacific		West Central		Central		Eastern	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent.	Std. Error
96.6	(0.3)	97.1	(0.2)	94.9	(0.4)	94.0	(0.2)

c. Percentage of lambs born alive (number of lambs born alive as a percentage of all lambs born), by primary flock type:

Percent Lambs					
Primary Flock Type					
Herded/Open Range		Fenced Range		Farm Flock	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
97.2	(0.3)	97.1	(0.2)	95.0	(0.3)

7. Lambs born per ewe

The overall lambing rate for operations that had completed their lambing by July 1, 2001, was 1.38 lambs per ewe. This rate was higher in the Central and Eastern regions, which have predominantly farm flocks, and lower in the Pacific and West Central regions, where the majority of ewes were on range flocks. Both herded/open range flocks and fenced range flocks had a lower lambing rate than farm flocks.

a. Number of lambs born per ewe exposed*, by region:

Number of Lambs									
Region									
Pacific		West Central		Central		Eastern		All Operations	
No.	Std. Error	No.	Std. Error	No.	Std. Error	No.	Std. Error	No.	Std. Error
1.34	(0.02)	1.29	(0.02)	1.55	(0.02)	1.62	(0.03)	1.38	(0.01)

*Does not include ewes removed from operation prior to lambing.

b. Number of lambs born per ewe exposed, by primary flock type:

Number of Lambs					
Primary Flock Type					
Herded/Open Range		Fenced Range		Farm Flock	
Number	Standard Error	Number	Standard Error	Number	Standard Error
1.31	(0.04)	1.25	(0.02)	1.55	(0.02)

8. Docking

The majority (97.6 percent) of operations docked lambs' tails, and the majority (98.1 percent) of lambs on these operations had their tails docked. While the percentage of operations that docked tails varied little by region, the percentage of lambs whose tails were docked on the operation did vary. Compared to the other regions, there were more operations in the Eastern region that reported docking the tails of a smaller percentage of lambs. A larger variation of responses and fewer operations contributed to the bigger standard error for the Eastern region. On most operations, lambs had their tails docked within 1 week of birth.

a. Percentage of operations that docked lambs' tails (and percentage of lambs docked or that would be docked), by region:

Measure	Region									
	Pacific		West Central		Central		Eastern		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Percent operations	98.9	(0.6)	98.9	(0.8)	95.9	(2.3)	99.6	(0.3)	97.6	(1.1)
Percent lambs ¹	97.7	(0.9)	98.9	(0.5)	98.0	(0.7)	90.7	(4.1)	98.1	(0.4)

¹Lambs docked as a percentage of lambs born alive.

b. Percentage of operations by age (in days) that most lambs' tails were docked, and by region:

Percent Operations									
Region									
Age (in Days)	Pacific		West Central		Central		Eastern		All Operations
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct. Std. Error
1 to 7	58.2	(6.4)	43.2	(5.0)	60.3	(4.7)	57.8	(6.5)	55.3 (2.8)
8 to 21	16.9	(4.3)	15.1	(2.4)	33.0	(4.6)	30.9	(6.0)	25.8 (2.5)
22 or more	24.9	(5.7)	41.7	(4.8)	6.7	(2.1)	11.3	(4.0)	18.9 (2.0)
Total	100.0		100.0		100.0		100.0		100.0

i. Percentage of operations by age (in days) that most lambs' tails were docked, and by primary flock type:

Percent Operations						
Primary Flock Type						
Age (in Days)	Herded/Open Range		Fenced Range		Farm Flock	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
1 to 7	25.4	(5.4)	31.1	(5.9)	60.9	(3.2)
8 to 21	6.0	(2.8)	25.4	(6.0)	26.5	(2.9)
22 or more	68.6	(6.0)	43.5	(6.0)	12.6	(2.1)
Total	100.0		100.0		100.0	

9. Grafting and feeding milk replacer

a. For operations that completed lambing by July 1, 2001, percentage of operations that grafted lambs from the last completed lamb crop onto other ewes or gave lambs milk replacer, by flock size:

Percent Operations								
Flock Size (Number of Ewes 1 Year or Older)								
	Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Procedure	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Either grafted or gave milk replacer	70.2	(3.2)	75.2	(2.8)	63.4	(3.6)	70.7	(2.6)

10. Lamb deaths

Only 49.2 percent of operations had weaned their last lamb crop by July 1, 2001, and even fewer (10.8 percent) of herded/open range flocks had done so. For operations that had completed weaning their last lamb crop by July 1, 2001, 8.3 percent of the lambs born alive had died or were euthanized before weaning. The percentage of lambs that died or were euthanized was higher in small flocks, but better knowledge of their lamb crop, rather than a true increase in lamb deaths, may explain the higher percentage.

a. Percentage of operations that weaned their last completed lamb crop by July 1, 2001, by primary flock type:

Percent Operations							
Primary Flock Type							
Herded/Open Range		Fenced Range		Farm Flock		All Operations	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
10.8	(6.4)	48.1	(6.0)	49.9	(3.2)	49.2	(2.8)

b. Percentage of operations that weaned their last completed lamb crop by July 1, 2001, by region:

Percent Operations							
Region							
Pacific		West Central		Central		Eastern	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
48.0	(6.7)	27.3	(4.4)	62.0	(4.4)	47.4	(6.7)

c. For operations that weaned their last completed lamb crop, percentage of lambs born alive that died or were euthanized before weaning, by flock size:

Percent Lambs							
Flock Size (Number of Ewes 1 Year or Older)							
Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
10.5	(0.8)	7.2	(0.7)	5.9	(0.8)	8.3	(0.5)

d. For operations that weaned their last completed lamb crop, percentage of lambs born alive that died or were euthanized before weaning, by primary flock type:

Percent Lambs					
Primary Flock Type					
Herded/Open Range		Fenced Range		Farm Flock	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
7.5	(1.6)	6.5	(0.8)	9.4	(0.6)

For lambs that died or were euthanized before weaning, the highest percentage were lost during the first 24 hours after birth. This was especially true for small flocks, which reported a higher percentage of lambs lost in the first 24 hours after birth than did medium or large flocks. Small flocks were more likely to keep track of each lamb born, compared to large range flocks, which may have known only that lambs died sometime before weaning. Better knowledge of lamb births and deaths probably contributed to the higher death rate in small flocks, as compared to medium and large flocks.

e. Of lambs that died or were euthanized, percentage of lambs that died, by age and by flock size:

Percent Lambs								
Flock Size (Number of Ewes 1 Year or Older)								
Age	Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
First 24 hours	42.8	(3.9)	33.1	(3.5)	28.6	(3.4)	37.8	(2.6)
More than 24 hours but less than 1 week	30.1	(2.4)	38.4	(5.3)	27.9	(3.1)	31.8	(2.1)
1 week or more but before weaning	27.1	(3.5)	28.5	(3.5)	43.5	(5.3)	30.4	(2.5)
Total	100.0		100.0		100.0		100.0	

Section II: Methodology

A. Needs Assessment

NAHMS develops study objectives by exploring existing literature and contacting industry members about their informational needs and priorities during a needs assessment phase. The needs assessment for the NAHMS Sheep 2001 study afforded producers and others affiliated with the sheep industry the opportunity to prioritize sheep health and productivity issues so that the study could focus on the areas of greatest importance. The objective of the needs assessment was to collect information from U.S. sheep producers and other commodity specialists about what they perceived to be the most important sheep health and productivity issues. A driving force of the needs assessment was the desire of NAHMS researchers to receive as much input as possible from a variety of sheep producers, as well as from industry experts and representatives, veterinarians, sheep extension specialists, universities, and sheep organizations. The data collected from the needs assessment helped set the focus and objectives for the study by concentrating on areas most important to the industry.

The primary needs assessment data collection method used was a population survey (the "Sheep Health Study Survey") to collect qualitative data. The survey was accessible in one of two ways: by linking to the USDA:APHIS:VS Web site or by calling a 1-800 telephone number. The survey was made available beginning February 15, 2000, and it was initially scheduled to terminate March 31, 2000. However, in order to capture as many responses as possible, and because there was a fairly high response rate, the data collection period was extended to April 30, 2000. The Web/phone hits were automated and put into a database for statistical analysis at a later date. Surveys also were distributed to all State veterinarians, as well as to a number of sheep extension specialists, sheep organization leaders, and university agriculture researchers in every State. The survey also was advertised in American Sheep Industry Association (ASI) newsletters, in major sheep magazines such as *The Shepherd*, and in numerous other sheep association publications and bulletins. A total of 459 surveys were completed, either on the Internet, on the phone, or via mailed-in hard copy. Conference calls and five focus-group meetings (USAHA 1998, American Sheep

Industry 1999 and 2000, and the American Farm Bureau Federation in 1999 and 2000) with industry leaders also were simultaneously conducted to gain a balanced perspective of current sheep health concerns during discussion-based meetings.

Specific objectives for the NAHMS Sheep 2001 study:

1. Estimate the regional and national prevalence of specific diseases and conditions of sheep, such as Johne's, intestinal parasites, abortions, and ovine progressive pneumonia.
2. Conduct genomic testing for genetic factors that may be related to susceptibility to clinical signs of scrapie. Describe the prevalence of potential risk factors believed to be associated with scrapie.
3. Describe health management practices used by U.S. sheep producers affecting morbidity (e.g., footrot) and mortality. These practices include animal movement and identification, feeding practices, biosecurity procedures, use of veterinary services, source of health information, vaccination, and treatment practices.
4. Describe nutritional practices and micronutrient intake levels that may impact sheep health by region.

B. Sampling and Estimation

1. State selection

The preliminary selection of States to be included in the study was done in January 2000, using the National Agricultural Statistics Service (NASS), USDA January 29, 1999, Sheep and Goat Report. A goal for NAHMS national studies is to include States that account for at least 70 percent of the animal and producer populations in the United States. The initial review of States identified 16 major States with 82 percent of the inventory but only 62 percent of the operations. A review in January 2000 suggested an increase in the number of States in the Central and Eastern regions.

A workload memo identifying the 19 States in relation to all States in terms of size (inventory and operations) was provided to the USDA: APHIS: VS Regional Directors on February 2000. Each of the Regional Directors sought input from their respective States about being included or excluded from the study. The 19 States provided coverage of 86 percent of the sheep in the United States and 70 percent of the operations. The States were: CA, CO, IA, ID, IL, IN, KS, MN, MT, NM, OH, OR, PA, SD, TX, UT, VA, WI, and WY. By midyear, three additional States were included based on State interest : AR, NV and WA. As of January 1, 2001, these 22 States accounted for 87.4 percent (6,039,000 head) of the sheep and lambs in the United States and 72.3 percent (47,700) of the operations with sheep or lambs in the United States (See appendix II for respective data on individual States.)

2. Operation selection

A review of the size of operations based on data from the 1997 Census of Agriculture showed a large proportion of small farms (54.1 percent of all the 65,790 farms with sheep or lambs had 1-24 head). For this reason the reference population was chosen to be those operations with one or more head.

The list sampling frame was provided by the NASS. Within each State a stratified random sample was selected. The size indicator was total sheep and lamb inventory for each operation. As shown in Appendix II, the number of sheep producers has been declining at a steep pace. This suggested that the results from the list frame sample might produce an expected high level of sampling units that were no longer in the sheep business, deceased, etc. To minimize this drop in sampling efficiency a screening sample concept was applied. NASS selects a sample of sheep producers in each State for making the NASS January 1 sheep estimates. The list sample from the January 2000 survey was used as the screening sample (n=12,258). Those producers reporting one or more sheep or lambs on January 1, 2000, were included in the sample for contact in January 2001. Due to the large predicted workload the sample was reduced in some States by excluding a replicate(s), as necessary, for a final screening sample of 9,964 operations. For the VS phase, operations with 20 or more ewes that participated in the NASS phase were invited to continue in the study.

3. Population inferences

Inferences from Phase I data collection cover the population of sheep producers with at least 1 sheep in the 22 States. These States accounted for 72.3 percent of the operations with sheep or lambs in the United States and 87.4 percent of the sheep and lamb inventory as of January 1, 2001. All respondent data were statistically weighted to reflect the population from which they were selected. The inverse of the probability of selection for each operation was the initial selection weight. This selection weight was adjusted for nonresponse within each State and size group to allow for inferences back to the original population from which the sample was selected. For those operations eligible for Phase II data collection (those with 20 or more ewes), weights were adjusted for those operations not wanting to continue to the study's second phase. This weight was adjusted again for nonresponse to Phase II data collection. The Phase II data collection weight was adjusted for nonresponse to Phase III data collection. The 22-State target population of operations with 20 or more ewes was estimated to represent 42.1 percent of all sheep operations and 92.6 percent of ewes in the 22 States on January 1, 2001 (see Appendix II).

C. Data Collection

1. Phase I: General Sheep Management Report, December 29, 2000-January 26, 2001. NASS enumerators administered the General Sheep Management Report. The interview took slightly over 1 hour.
2. Phase II: Reference of Sheep Health in the United States, 2001. Data were collected from producers by Federal or State veterinary medical officers (VMOs) or animal health technicians (AHTs) from February 5, 2001, to April 27, 2001. The interview took approximately 1.5 hours.
3. Phase III: Lambing Practices, Spring 2001. Data were collected from producers by Federal and State veterinary medical officers (VMOs) or animal health technicians (AHTs) from June 4 to June 29, 2001. Most (70.0 percent) of the surveys were completed by phone interview, which took approximately 29 minutes.

D. Data Analysis

1. Validation and estimation

- a. Initial data entry and validation for the General Sheep Management Report were performed in individual NASS State offices. Data were entered into a SAS data set. NAHMS national staff performed additional data validation on the entire data set after data from all States were combined.

b. Completed Initial Visit Questionnaires were sent to State NAHMS Coordinators, where they were manually reviewed for accuracy and then sent to CEAH. Data entry and validation for the initial visit were completed at CEAH and entered into SAS.

c. Completed VS telephone surveys were sent to State NAHMS coordinators. The surveys were reviewed manually for accuracy and then sent to CEAH. Data entry and validation for the telephone survey were then entered into SAS.

2. Response rates

a. Phase I: Of the 9,964 operations in the screening sample, 4,884 operations had no sheep or lambs on January 1, 2000, and were therefore ineligible for the NAHMS Sheep 2001. This left a total of 5,080 operations to be contacted by NASS in January 2001 (see table below). Of these 5,080 sheep operations, 3,210 participated in this initial phase of the Sheep 2001 study. This phase occurred from December 29, 2000, to January 26, 2001, and included the administration of a questionnaire by NASS enumerators.

Response Category	Number Operations	Percent Operations
No sheep on January 1, 2001	468	9.2
Out of business ¹	159	3.1
Refusal	870	17.1
Survey complete and VMO consent	1,775	35.1
Survey complete, refused VMO consent	993	19.4
Survey complete, ineligible for VMO	442	8.7
Out of scope (prison, research farm, etc.)	51	1.0
Inaccessible	322	6.4
Total	5,080	100.0

¹Operations that sold land and/or sheep and had no intention of returning to sheep business.

b. Phase II: VS initial visit response categories are shown below for all 1,775 producers turned over to VS with 20 or more ewes. Of these, 1,101 producers participated.

Response Category	Number Operations	Percent Operations
Survey completed	1,101	62.0
Producer not contacted	149	8.3
Poor time of year or no time	189	11.0
Did not want anyone on operation	6	0.3
Bad experience with government veterinarians	7	0.3
Did not want to do another survey or divulge information	131	7.4
Told NASS they did not want to be contacted	7	0.3
Ineligible (no sheep)	32	1.8
Other reason	40	2.2
Unable to contact	113	6.4
Total	1,775	100.0

c. Phase III: Response categories for the interviews (primarily by telephone) are shown below for all 1,101 producers who participated in the VS initial visit Phase II. Of these, 870 producers or 79.0 percent participated in the survey.

Response Category	Number Operations	Percent Operations
Survey completed	870	79.0
Producer not contacted	155	14.1
Poor time of year or no time	15	1.4
Did not want to do another survey or divulge information	28	2.5
Ineligible (no sheep)	8	0.7
Other reason	25	2.3
Total	1,101	100.0

Appendix I: Sample Profile

A. Responding Operations

1. Responding Operations by Flock Size

Phase I: General Sheep Management Report		Phase II: VMO Initial Visit		Phase III: Telephone Survey	
Flock Size (Number of Sheep)	Number of Responding Operations	Flock Size (Number of Ewes)	Number of Responding Operations	Number of Responding Operations	Percent Responding
1-24	448	Less than 100	536	432	80.6
25-99	956	100-499	368	293	79.6
100-999	1,370	500 or more	197	145	73.6
1,000 or more	436	Total	1,101	870	79.0
Total	3,210				

2. Responding Operations by Region

Phase I: General Sheep Management Report		Phase II: VMO Initial Visit		Phase III: Telephone Survey	
Region	Number of Responding Operations	Number of Responding Operations	Number of Responding Operations	Number of Responding Operations	Percent Responding
Pacific	416	168	141		83.9
West Central	1,335	436	336		77.1
Central	1,048	340	273		80.3
Eastern	411	157	120		76.4
Total	3,210	1,101	870		79.0

3. Responding Operations by Primary Flock Type

Phase I: General Sheep Management Report		Phase II: VMO Initial Visit	Phase III: Telephone Survey	
Region	Number of Responding Operations	Number of Responding Operations	Number of Responding Operations	Percent Responding
Herded/Open Range	219	87	56	64.4
Fenced Range	938	293	237	80.9
Farm Flock	1,975	714	571	80.0
Feedlot	78	7	6	85.7
Total	3,210	1,101	870	79.0

Appendix II: U.S. Sheep and Lamb Inventory and Operations

Nass¹

A. Regional Summary

Region	State	Number (Thousand Head) January 1, 2001		Number of Operations with Sheep Year 2000	Percent ²		
		Ewes 1 Year or Older	All Sheep and Lambs		Ewes on Operations With 20 or More Ewes	Sheep on Operations With 20 or More Ewes	Operations with 20 or More Ewes
Pacific	California	320	840	3,000			
	Oregon	120	245	3,000			
	Washington	35	54	1,200			
	Total	475	1,139	7,200	90.6	86.3	31.9
West Central	Colorado	165	420	1,900			
	Idaho	195	275	1,000			
	Montana	265	360	2,000			
	Neveda	68	95	300			
	New Mexico	165	255	900			
	Texas	710	1,150	6,800			
	Utah	300	390	1,500			
	Wyoming	340	530	900			
	Total	2,208	3,475	15,300	96.9	81.5	46.9
Central	Arkansas	N/A	N/A	N/A			
	Illinois	48	75	2,400			
	Indiana	45	66	2,200			
	Iowa	144	270	4,700			
	Kansas	58	110	1,500			
	Minnesota	90	170	2,600			
	South Dakota	265	420	2,300			
	Wisconsin	53	80	2,200			
	Total	703	1,191	17,900	86.5	77.0	44.6
Eastern	Ohio	86	142	3,600			
	Pennsylvania	54	81	2,500			
	Virginia	37	61	1,300			
	Total	177	284	7,400	78.9	77.6	40.1
Total (22 States)		3,563 (87.1% of U.S.)	6,089 (87.4% of U.S.)	47,800 (72.3% of U.S.)	92.6	81.2	42.1
Total U.S. (50 States)		4,091	6,965	66,100			

N/A = not available

¹ Source: National Agricultural Statistics Service (NASS), USDA; NASS Sheep and Goats, February 1, 2002

² Source: Percentage estimates generated based on NAHMS Phase I data collection.

B. Size Group Summary

1. Source: United States Census of Agriculture, U.S. Department of Commerce, 1997

Sheep and Lamb Size Groups	Sheep and Lamb Inventory Dec. 1, 1997 (Thousand Head)	Farms (Operations) With Sheep and Lambs 1997
1-24	349	35,584
25-99	959	20,461
100-299	963	6,010
300-999	1,237	2,429
1,000-2,499	1,255	820
2,500-4,999	1,000	297
5,000 or more	2,059	189
Total	7,822	65,790

2. Source: United States Department of Agriculture, NASS

Breeding Sheep	Percent	
	Inventory January 1, 2001	Operations
1-99	28.8	90.8
100-499	23.8	7.5
500-4,999	33.7	1.6
5,000 or more	13.7	0.1
Total	100.0	100.0

Sheep 2001 Study: Completed and Expected Outputs and Related Study Objectives

1) Estimate the regional and national prevalence of specific diseases and conditions of sheep, such as Johne's, intestinal parasites, abortions, and ovine progressive pneumonia.

- Johne's and the U.S. Sheep industry (info sheet)
- Intestinal parasites in U.S. Sheep (info sheet)
- Seroprevalence of Ovine Progressive Pneumonia in U.S. sheep (info sheet)

2) Conduct genomic testing for genetic factors that may be related to susceptibility to clinical signs of scrapie.

- Describe the prevalence of potential risk factors believed to be associated with scrapie.
- PrP genotype distributions of U.S. sheep
- Scrapie associated risk factors and related management practices in the United States.

3) Describe health management practices used by U.S. sheep producers affecting morbidity (e.g., footrot) and mortality. This would include animal movement and identification, feeding practices, biosecurity procedures, use of veterinary services, source of health information, vaccination, and treatment practices.

- Part I: Reference of Sheep Management in the United States, 2001, July 2002
- Highlights of NAHMS Sheep 2001: Part I
- Part II: Reference of Sheep Health in the United States, 2001, April 2003
- Highlights of NAHMS Sheep 2001: Part II, April 2003
- Lamb Marketing Patterns in the United States, 2000 (info sheet) April 2003
- **Part III: Lambing Practices, Spring 2001, April 2003**
- Highlights of NAHMS Sheep 2001: Part III, April 2003
- Part IV: Baseline Reference of 2001 Sheep Feedlot Health and Management
- Quality Assurance and Biosecurity Practices on U.S. Sheep Operations, expected spring 2003
- Vaccination and Treatment Practices on U.S. Sheep Operations, expected spring 2003

4. Describe nutritional practices and micro nutrient intake levels that may impact sheep health, by region.

- Composition of Forage Analyzed as part of the Sheep 2001 Study, expected spring 2003
- Nutritional Practices of U.S. Sheep Producers, expected spring 2003

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